OUR BOOK SHELF.

A Treatise on Chemistry. By Sir H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S. Vol. III. "The Chemistry of the Hydrocarbons and their Derivatives; or, Organic Chemistry." Part VI. (London: Macmillan and Co., 1892.)

THE present section of this well-known work deals with the derivatives of naphthalene and the allied hydrocarbons—phenanthrene, chrysene, &c.; also with the compounds containing two or more benzene nuclei directly united, such as diphenyl.

The extraordinary expansion which this particular branch of organic chemistry has undergone during the last fifteen years is due in part doubtless to the fascination of the various problems of constitution which these compounds offer, and to the well-founded assurance that Kekulé's benzene theory, which had thrown so much light on the subject of benzene itself and its more immediate derivatives, would prove an equally trustworthy guide in the case of the more complex hydrocarbons of the same class. But it is doing no injustice to pure chemists to say that a great part of this expansion is attributable to the fact that numerous valuable practical applications have been found for some of the compounds in question.

In 1876, when Wurtz published his "Progrès de l'Industrie des Matières Colorantes Artificielles," the colouring-matters derived from naphthalene might be counted on the fingers of one hand, and not more than two of these—Magdala red and Manchester yellow—were really manufactured; whilst from diphenyl not a single dye-stuff had been prepared. At the present moment, only a specialist in this branch could estimate, even approximately, the number of the naphthalene dyes; and within the last few years another important class of dyes, possessing the hitherto unknown property of dyeing cotton without a mordant, has been discovered among the derivatives of diphenyl.

The industrial source of much of our knowledge in this branch of chemistry is clearly shown in the fact that in the work now before us the references are not confined to the familiar scientific periodicals, but extend to the patent literature of various countries and to works like Schultz's "Steinkohlentheer" and Friedländer's "Theerfarben." Without going into unnecessary detail, the authors succeed in giving all which it is necessary for the student of organic chemistry to know regarding these matters.

The questions of constitution are treated very fully and clearly. The reader who wishes to gain an idea of what organic chemists have accomplished, in the solution of problems which but a few years ago would have been regarded as utterly beyond the scope of rational investigation, cannot do better than study carefully the chapter on the constitution of the naphthalene derivatives.

The authors continue to follow their excellent practice of giving interesting historical details by way of introduction to the study of the more important compounds.

The Oak: a Popular Introduction to Forest Botany. By H. Marshall Ward, M.A., F.R.S., F.L.S. "Modern Science Series," edited by Sir John Lubbock, Bart., M.P. 171 pages, and Index, 2 Plates, and 51 Woodcuts. (London: Kegan Paul, Trench, Trübner, and Co., Ltd., 1892.)

THIS little book fills a distinct gap, as it is the first time that a primer intended specially for students of forestry has been issued in England. Prof. Marshall Ward has been for many years the Lecturer on Botany at the Royal Indian Engineering College at Cooper's Hill, and therefore understands thoroughly what is required. He has followed for his plan the taking of a single tree—the oak—and dealing with it exhaustively. After a general introduction, he deals first with the acorn and its germination, describing fully the embryo and its epidermis, the vascular bundles of the former and its cells, and the character of their contents. He tells us that two years elapse before the supply of food stored up in the two thick cotyledons is exhausted, and it is not until the tree is from sixty to a hundred years old that good seeds are obtained from it. Then he describes the seedling and young plant—first the root and its tissues, and then the stem, buds, and leaves, and their microscopic structure. Then he turns to the full-grown tree, and describes its root-system shoot-system, inflorescence, flowers, fruit, and seed. Next he deals with the timber of the oak, its structure, and technological peculiarities. Then he treats of the cultivation of the tree, and the injuries and diseases to which it is liable from the attacks of insects and fungi. He concludes with a short chapter on the relationships of the oaks and their distribution in space and time. The genus is characterized by the cupule, in which the acorn is inclosed, which represents a one-flowered involucre. There are three cells in the ovary, and two ovules in each; but nearly always two of the cells and five of the ovules are obliterated before the seed is perfected. About 300 species of the genus *Quercus* are known. It is spread universally through the north temperate zone. Prof. M. Ward is mistaken in supposing there are no oaks in South America. Two species have long been known in the Northern Andes—*Quercus tolimensis* and *Quercus Humboldtii*—both of which are described and figured in Humboldt and Bonpland's "Plantes Equinoxiales." There are nearly sixty species in India, and it is there that we get the genus connected with the other Cupuliferæ by passing through *Castanopsis* into *Castanea*. The oaks go back to the Cretaceous period, and a large number of fossil forms are known. Their delimitation into species is very difficult. In Britain we have only a single species, *Quercus Robur*, with two sub species *Q. pedunculata* and *sessiliflora*, well enough marked in their extreme forms, but passing into one another by gradual stages of transition, which constitute what has been called *Quercus intermedia*. The book is clear and well arranged, and will be found thoroughly adapted to fulfil its purpose, and is illustrated by a large number of excellent figures, some of which are original and some borrowed from German text-books.

J. G. B.

The Elements of Plane Trigonometry. By R. Levett and C. Davison. (London: Macmillan, 1892.)

THOUGH the spirit of De Morgan's writings pervades these "Elements," there is ample evidence that the writers have taken an immense amount of pains in bringing them fully up to date. We have long given up looking for originality in a treatise on trigonometry; indeed, in a text-book for use in schools such a feature is hardly desirable, but there are not wanting here many novel features in the matter introduced and in its mode of treatment. De Morgan's influence is shown "in the use of the negative hypotenuse in defining the ratios, in the more definite meaning assigned to the notation for inverse functions, the manner in which the addition formulæ are extended to any number of variables, the geometrical treatment of the hyperbolic function and of complex numbers, and in the two-fold generalization of a logarithm to a given base." Another work to which the authors are indebted in Parts II. and III. is Prof. Chrystal's masterly treatise on algebra. In fact, they are *au courant* with whatever has recently been written bearing in any way upon their subject-matter.

The book is divided, like ancient Gaul, into three parts. The first treats of arithmetical quantity, in five

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chapters; the second of real algebraical quantity; and the third of complex numbers. The first two parts contain what is requisite for school use, the third is beyond the ordinary run of junior students. The whole has, we believe, stood the test of class work. In the second part the application of trigonometry to surveying is made interesting by treating the subject as practically as possible. There is a copy from a photograph of a theodolite, and a conversational description of the same, and in Part I., through the permission of the publishers, there is printed a portion of the map of the *Mer de Glace* given in the "Life of Prof. Forbes.' These little points are likely to interest young students. Of course the hyperbolic functions are discussed, but they are discussed in a way that is novel to us in some of the details; for instance, geometrical proofs are given of cosh $(u + v)$ and sinh $(u + v)$. These strike us as being very elegant and quite within school range, as they need only a moderate acquaintance with the properties of the rectangular hyperbola. A short space is occupied with the Gudermannian function, and a table of approximate values of hyperbolic functions is given in the same section. The section on convergency and continuity of series, and, in fact, the whole discussion of series, is very carefully done.

Our summing up is that the book is one of the best we have met with on the subject, and quite fitted to hold its own against the two or three formidable rivals that have lately appeared in the field. There is a plethora of carefully chosen examples, which we advise the junior student to use with Prof. Chrystal's caution in mind: "I should much deprecate the idea that any one pupil is to work all the exercises (in the 'Algebra') at the first or at any reading. We do too much of that kind of work in this country." The text is further illustrated by many *graphs* of different functions, and answers, carefully tested from working with pupils, are appended at the end, with tables of the logarithms required for the exercises.

Les Fleurs à Paris: Culture et Commerce. Par Philippe L. de Vilmorin. (Paris: J. B. Baillière et Fils, 1892.)

THE trade in cut flowers is now quite an important department of commerce, and it is rather surprising that a good many attempts have not been made to give a full and connected account of it. In the present volume M. de Vilmorin deals with the subject chiefly in its relation to Paris, and he has brought together many facts which will be of interest both to lovers of flowers and to students of social economy. He describes the various ways in which the trade is organized in the French capital, the sources from which the flowers are derived, the manner in which they are cultivated, and the means by which they are distributed. He then presents an account of the various kinds of flowers used for decorative purposes, giving in simple language such botanical details as are likely to be intelligible and attractive even to non-scientific readers. The volume is abundantly and very prettily illustrated.

Health Springs of Germany and Austria. By F. O. Buckland, M.D. Second Edition. (London: W. H. Allen and Co., 1892.)

THIS little book ought to be of considerable service to invalids who may desire to obtain aid in the choice of a Continental health resort. The author does not profess to present elaborate details as to the various springs with which he deals; but he says enough about each to give a sufficiently clear idea of its merits and defects. He offers also some good general remarks on the nature and uses of health springs. In the present edition he has made little change, but he has increased the value of the book by adding an index.

LETTERS TO THE EDITOR.

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Heat Engines and Saline Solutions.

I HAVE nothing to modify in what I have written under the above heading (p. 438); but to deal completely with all the questions raised by Mr. Macfarlane Gray (p. 486) would require half a treatise. I will limit myself to a few brief remarks.

(1) In Carnot's engine there is no (separate) boiler or condenser.

(2) When I spoke of the various parts of the working substance being in equilibrium with one another, I referred to complete equilibrium, thermal as well as mechanical. If the temperature varies from one part to another there is no equilibrium.

(3) On the above understanding the pressure of vapour in equilibrium with a saline solution of given strength is a definite function of the temperature.

(4) Let me suggest that the origin of the difficulty may lie in the phrase "superheated vapour," which has not so definite a meaning as Mr. Gray seems to ascribe to it. Whether vapour be superheated or no, depends, not only upon the condition of the vapour itself, *but also upon the bodies with which it is in contact.* Vapour which is merely saturated in contact with a saline solution must be regarded as superheated when contact with the solution is cut off. In the first situation it would condense upon compression, and in the second situation it would not.

In conclusion, I will hazard the prediction that, if the heat engines of the distant future are at all analogous to our present steam engines, either the water (as the substance first heated) will be replaced by a fluid of less inherent volatility, or else the volatility of the water will be restrained by the addition to it of some body held in solution.

RAYLEIGH.

On Earth Vibrations.

IT seems that the earth, once set in vibration, maintains this state for a long time before coming to rest. The observers of Greenwich (see Major H. S. Palmer in the Transactions of the Seismological Society of Japan, vol. iii., p. 148) found that from time to time, at considerable intervals, there was an evening when the usual observations for determining the collimation-error of the transit-circle by means of reflection in a tray of mercury could not be taken, on account of the constant trembling of the surface of the mercury, which on such occasions continued until long past midnight. These are occasions when crowds of the poorer classes of London flock for amusement to Greenwich Park. A favourite pastime with the young people, often prolonged until after nightfall, is to clamber to the top of the steep slopes of the hill on which the Observatory stands—in fact, to the paling of the enclosure—and then, joining hands in twos or threes, to bolt precipitately to the bottom, where, as may be imagined, they usually arrive "all in a heap." Hundreds join in this sport on fine evenings, and the result, as shown by the behaviour of the mercury, is to set the whole of Flamsteed Hill in a tremor, which does not subside until early next morning, many hours after the people have left.

Another very beautiful proof of this fact offered itself to me in the Geophysical Observatory of Rocca di Papa, Rome. A slight earthquake coming from Aquila (at 110 kilometres north-east of Rocca di Papa) was felt and registered by the instruments at 9.39 a.m. mean time of Rome, on the 8th of last February. Just at that time I was casually observing through a microscope a pendulum 6 cm. long, which suddenly began to display great agitation.

Now such a pendulum, when removed from its equilibrium position for an amplitude equal to the observed, comes to rest in about half-an-hour. In the present case the pendulum continued to oscillate till the afternoon. Nor did the character of the vibrations correspond to the gradually and regularly diminishing oscillation of a pendulum which has received a single shock. The pendulum is firmly fixed to a big column, deeply founded

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